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## THE STRIPED HARVEST-SPIDER: A STUDY IN VARIATION.

BY CLARENCE M. WEED.

In 1821 Thomas Say described in the Journal of the Academy of Natural Sciences of Philadelphia two species of harvest-spiders, one of which he named *Phalangium vittatum* and the other *Phalangium dorsatum*. He stated that the former "inhabits the Southern States" and that the latter "inhabits the United States." His descriptions in both cases were evidently drawn up from specimens not fully matured, and the characterizations are meagre and unsatisfactory. The two species are said to be similar in color, but distinguished from each other by the "terminal joint of the palpi being pectinated with spines" in *P. dorsatum*.

In 1868 Dr. H. C. Wood published extended descriptions of both these species.<sup>1</sup> He states that they are closely related, "the principal characters separating the two being found in the differences in coloration of the dorsum and legs, the trochanter not being black in *P. vittatum*, and the much greater hardness and roughness of the upper surface of the southern species." He adds that *P. vittatum* "may be looked upon as the southern representative of its nearest ally, *P. dorsatum*, of which I have never seen any specimens from farther south than Washington City."

Since Dr. Wood's paper was published I have treated of<sup>2</sup> these species two or three times, taking them out of the old genus *Phalangium*, and referring them to *Liobunum*. In 1889 I stated that "after examining hundreds of specimens of *dorsatum* and dozens of *vittatum*, I am unable to find any constant structural character by which they may be separated, though the difference in the size of the body and length of legs is very marked."

<sup>1</sup>Comm. Essex Institute, VI, pp. 18-21.

<sup>2</sup>AMER. NAT., XXI, p. 935; Bull. Ill. St. Lab. Nat. Hist. III, pp. 83-87.

TABLE I. LIOBUNUM VITTATUM SAY. MALE. COLUMBUS, OHIO.

No. of Specimen.	Measurements of body in mm.		Measurements of legs in mm.				Remarks.
	Length.	Width.	1st pair	2d pair	3d pair	4th pair	
1	—	—	33	67.4	34.4	49	Body not measured. Collected 20 Sept., 1889.
2	—	—	33	65.6	34	42.4	" " " " " "
3	—	—	34.6	67.6	35	50	" " " " " "
4	—	—	31.6	63.4	32	46	" " " " " "
5	—	—	35.4	70	35.8	50	" " " " " "
6	—	—	35	71	35.6	49	" " " " " "
7	—	—	35	70.6	34.6	51	" " " " " "
8	—	—	35	72	36	51	" " " " " "
9	—	—	34.4	69	36	51	" " " " " "
10	—	—	35	67	35.2	49	" " " " " "
11	6.2	—	38.8	76	38	54.6	Collected 26 Sept., 1889.
12	6.8	—	35.4	69.8	36	50.6	" " " " " "
13	6.2	—	35	66.4	35.8	49.6	" " " " " "
14	5.2	—	39.4	76	40.2	57	" " " " " "
15	6.4	3	37.4	77.2	38	55	" " " " " "
16	5.8	—	33	67.4	33.4	47	" " " " " "
17	8	—	35.4	72.4	35.4	52	" " " " " "
Longest.	8	—	39.4	77.2	40.2	57	
Shortest.	5.2	—	31.6	63.4	32	42.4	
Difference.	2.8	—	7.8	13.8	8.2	14.6	
Average.	6.3	—	35	69.8	35	50.2	

During the last eight years I have collected hundreds of these striped harvest spiders in half a dozen States—some of them widely separated—and have received from correspond-

TABLE II. *LIOBUNUM VITTATUM* DORSATUM SAY. MALE. URBANA, ILLINOIS.

No. of Specimen.	Measurements of body.			Measurements of legs.				Length of Palpi.	Remarks.
	Length.	Breadth.	Height.	1st pair	2d pair	3d pair	4th pair		
1	5.5	4	3	28	55	27.5	39	6	Collected 9 August, 1887. " " " " " " " "
2	6	4	3	25	50	26	37	6.7	
3	6	4	3	26.5	54	27.5	40	7	
4	5.5	4	3	25	45	25	34	6	
5	6	4	3	24	46	24	34	6.5	
6	6	4	3	26	51	26	37.5	6	
Longest.	6	4	3	28	55	27.5	40	7	
Shortest.	5.5	4	3	24	45	24	34	6	
Difference.	.5	0	0	4	10	3.5	6	1	
Average.	5.8	4	3	25.7	50.1	26	38.9	6.3	

ents many specimens from other localities. After a careful study of the material thus accumulated—aggregating nearly a thousand specimens—I conclude that we have to do with a single very variable species, in which natural selection has

increased the size of body and the length of legs to the southward, and shortened them in the north. The points of difference indicated by Say and Wood prove without value when many specimens are examined.

The harvest-spiders are well adapted for the study and illustration of organic variation. Their long legs are easily measured, and the results can be set down in black and white, with more striking effect than in the case of most invertebrates.

To determine the variability of the species in a given locality I measured seventeen fully developed males taken in the fall of 1889 at Columbus, Ohio. The results are shown in table I:

This shows a striking and constant variation, the longest of the fourth pair of legs being one-third longer than the shortest, and the difference in the other legs being nearly as great.

To determine whether similar variations occurred in other localities, six fully developed males, collected on the farm of the University of Illinois, were measured, with the results shown in Table II:

The fact that there was a difference of ten millimetres in the length of the second pair of legs in the case of six specimens, selected at random, indicates that this amount of variation, at least, is normal to the species in that locality.

Two fully developed males sent by Mr. J. M. Aldrich from Brookings, South Dakota gave the following measurements:

TABLE II. *LIQBUNUM VITTATUM DORSATUM* SAY. MALE. BROOKINGS, SOUTH DAK.

No. of Specimen	Measurements of body.			Measurements of legs.				L'n'th of palpi	Remarks.
	Length	Breadth	Height	I	II	III	IV		
1	5	4	2.5	21	34	21	29	6.2	
2	5	3.5	2.3	19	35	19	26	6.1	
Average	5	3.8	2.4	20	34.5	20	27.5	6.15	

In striking contrast to this are the following measurements of two fully developed males from Mr. H. E. Weed, collected at the Mississippi Agricultural College:

TABLE IV. LIOBUNUM VITTATUM SAY. MALE. AGRICULTURAL COLLEGE, MISS.

No of Specimen	Measurements of body.			Measurements of legs				L'n'th of palpi	Remarks.
	Length	Breadth	Height	I	II	III	IV		
1	7	5	3.6	46	90	46	66	7.5	
2	7.5	4.5	3.5	47	90	46	65	7.5	
	7.25	4.75	6.55	46.5	90	46	65.5	7.5	

In Tables III and IV we have the two extremes in the size of the species, so far as my specimens show it. In the presence of these alone one would unhesitatingly decide that they belonged to two well marked species. The fact that in size of body the Mississippi form is nearly one-third larger; and that the first, third and fourth pairs of legs are considerably more than twice as long, while the second pair is nearly three times as long would in the absence of intermediate forms, fully justify such a separation. But a reference to Tables I and II drawn up from specimens taken about half way between Dakota and Mississippi shows that the size of the species in those localities is intermediate between the two extremes, the second pair of legs in central Illinois averaging 50.1 mm. and in central Ohio 69.8 mm. against 34.5 mm in South Dakota and 90 mm. in Mississippi.

The measurements of individual specimens from various localities given in Table V below indicate that the size of body and length of legs varies greatly with the locality, as a rule the body becoming larger and the legs longer as we go southward.

TABLE V. LIOBUNUM VITTATUM SAY. MALES FROM VARIOUS LOCALITIES.

Locality.	Measurements of body.			Measurements of legs.				L'n'th of palpi
	Length	Breadth	Height	I	II	III	IV	
Iowa (Ames).....	—	—	—	—	45	—	—	—
S. Maine (Orono).....	6	3.7	3	32	60	33	44	6
N Illinois (Normal)...	6.5	4	3	31	59	31	45	6.7
N. Ohio (Brooklyn)....	5.5	4	3.1	35	67	35	—	—
S. Ohio (Ironton).....	6	4.2	3	40	82	40	58	6.4
Virginia (Blacksburg)	—	—	—	—	76	—	—	—
S. Illinois (Cobden)...	7	4	—	44	89	45	64	7

In the diagram on the following page I have reduced the lengths of the second pair of legs of the specimens from all the localities given above to straight lines, each line representing the precise length and the figures above it showing its measurement in millimetres. Where more than one specimen has been measured from a given locality the average is taken. It will be seen that the difference in the progressive lengthening from the north to the south is in no case greater than has been shown in Tables I and II to occur in a single locality. One can find no place where a line can be drawn separating the two forms. Considering in connection with this the fact that there are no structural or colorational differences separating the two, it seems to me evident that, as already stated, we have here a single widely variable species. As the description of *P. vittatum* precedes that of *P. dorsatum* in the original publication, the species should be known as *Liobunum vittatum* (Say) and the northern form as *L. vittatum dorsatum* (Say). It would apparently be well to refer to *dorsatum* the forms from those localities in which the average length of the second pair of legs in the males is less than 70 or possibly 75 mm.

The above records have reference only to the males but a number of measurements of female specimens show that they vary in a similar manner.

#### LIFE-HISTORY.

This species evidently passes the winter in the egg state as it has never been taken during the winter or early spring months. The eggs of the northern form apparently do not hatch very early, probably not until May, and the young grow slowly. Occasionally I have found a fully developed one during the latter part of June, but generally they do not become mature until July. My collections show two half grown specimens taken at Columbus, Ohio, July 30, 1888, and another collected in the same locality July 16, 1888, which is not fully developed.

When very young these harvest-men seem to prefer the shelter of the grasses, low herbage and rubbish piles, but as they grow larger they are to be found in a great variety of sit-

34.5	Brookings, South Dakota.
45	Ames, Iowa.
50.1	Urbana, Illinois.
59	Normal, Illinois.
60	Orono, Maine.
67	Brooklyn, Ohio.
69.8	Columbus, Ohio.
76	Blacksburgh, Virginia.
82	Ironton, Ohio.
89	Cobden, Illinois.
90	Mississippi.



uations. In the prairie regions of central Illinois, where nearly all of the country is occupied by corn fields and Osage orange hedges, the young are very common on the corn plants, where, as I have elsewhere surmised, they probably live upon the numerous small insects drowned in the moisture contained in the bases of the unfolding leaves, as well as on the corn plant lice (*Aphis maidis*). The full grown individuals are to be found nearly everywhere, on bushes and trees in the woods, in meadows and pastures, along fences, and in sheds and outhouses. They occur abundantly from July to October.

The only opportunity I have had of studying the long-legged southern form in the field was in southern Illinois during the autumn of 1886. Along the rocky ledges running across the State and through Union County, these harvest-spiders were exceedingly abundant, occurring everywhere on the rocks and ground. They were so numerous that as one walked in the open groves on the farm of Mr. Parker Earle they would run along in droves.

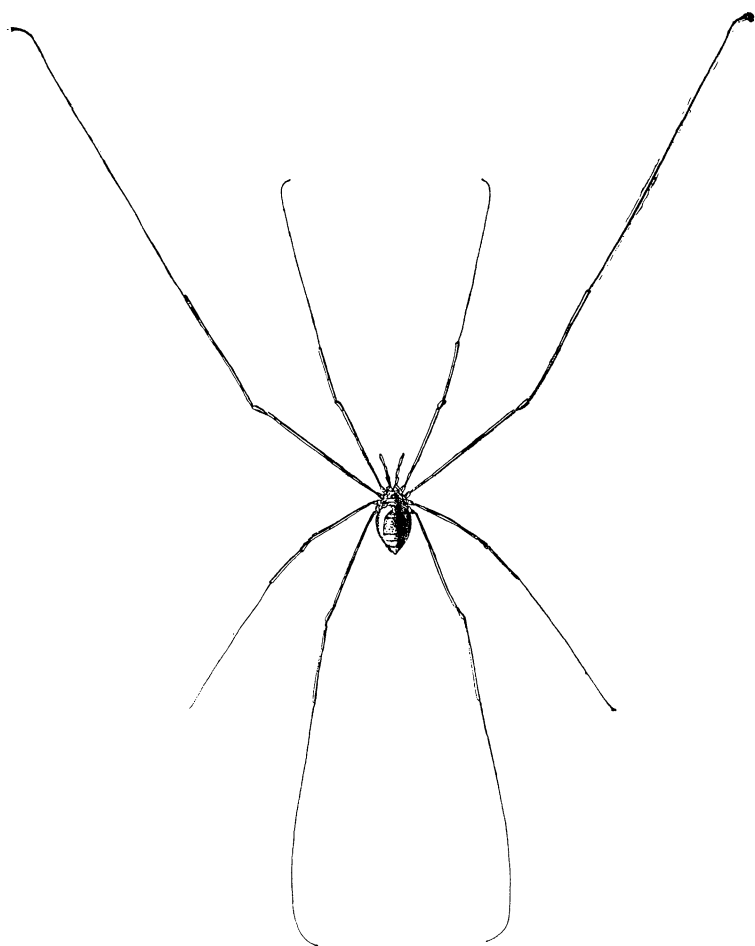
This species, like others of its family has the power of exuding from about the coxæ a liquid with a peculiarly disagreeable odor. This doubtless serves as a protection from birds and other enemies.

An idea of the difference in length of legs between the species as it exists in Dakota and Mississippi may be obtained by comparing Fig. I, Plate XXIX, with Plate XXVII, the first representing a specimen from the former locality, and the second, one from the latter State. The structural details of the two sexes of the southern form are represented magnified at Plate XXIX. In each figure, *a* represents the body with legs detached; *b*, a side view of the eye-eminent; *c*, a front view of the same; *d*, a side view of the palpus; and *e*, a side view of the palpal claw. The row of teeth-like tubercles on the inner border of the last joint of the male palpus do not show in the position from which the drawing was made. The engravings were made from drawings by Miss Freda Detmers.

#### DESCRIPTION.

The southern form of this species may be described as follows:

PLATE XXVIII.



*Liobunum vittatum* Say. Female. Mississippi.

MALE.—Body 7 mm. long; 4 mm. wide. Palpi 7 mm. long. Legs: I, 44 mm.; II, 89 mm.; III, 45 mm.; IV, 64 mm.

Dorsum reddish-brown, with a dark central marking, commencing at eye eminence and extending backward to the ultimate or penultimate abdominal segment. Contracting slightly near the anterior margin of abdomen, then gradually expanding until about the beginning of the posterior third of the abdomen, where it again slightly contracts. Ventrums slightly paler than dorsum, both finely granulate. Eye eminence a little wider than high, black above, canaliculate, with small black tubercles over the eyes. Mandibles light yellowish-brown, tips of claws black; second joint with short sparse hairs. Palpi long, reddish-brown; tarsal joints paler. Femur and patella arched with two rows of rather blunt dark tubercles on the outer ventro-lateral surface; femur also having a few small subobsolete ones on its dorsal surface. Tibia with a similar row on its outer ventro-lateral surface, a short row on the distal portion of its inner ventro-lateral surface, and a short row on the proximal portion of its ventral surface. Tarsus pubescent, with a row of short, blunt, black tubercles on its inner ventro-lateral surface, extending from the base to near the apex. Legs varying from light brown to black, but patella is generally black and tarsi brown, the other joints varying. Coxæ reddish-brown, minutely tuberculate. Trochanters generally dark brown with minute scattered tubercles. Femora and patellæ with rows of small spines. Tibiæ with very short hairs. Shaft of genital organ slender, subcylindrical, not broadened distally, but bent at an obtuse angle and terminating in a very acute point.

FEMALE.—Body 8-9 mm. long; 5-6 mm. wide. Palpi 5 mm. long. Legs: I, 42 mm.; II, 90 mm.; III, 43 mm.; IV, 61 mm.

Besides its rounder body and much more robust appearance, it differs from the male as follows: Dorsum of a much darker shade of brown with less of the reddish tint, and the ventrum paler. Second joint of mandibles with fewer hairs. Palpi shorter, more slender, with the rows of tubercles on the tibia subobsolete, and that on the tarsus entirely wanting. Legs

generally light brown, with black annulations at the articulations. Ovipositor whitish, with no dark color in the apical rings.

#### DISTRIBUTION.

The literature of *L. v. dorsatum* shows that this form occurs in Pennsylvania, New York, District of Columbia, Illinois and Michigan. I also have specimens before me from Iowa (Gillette), Ithaca, New York. (Comstock and Banks), Lincoln, Nebraska, (Bruner), Maine, (Harvey), South Dakota (Aldrich) and a large number collected in the central and northern counties of Ohio, as well as in Vermont and New Hampshire.

By the original describer the southern form (*L. vittatum*) is said to inhabit the southern States. Dr. Wood reports it from Texas and Nebraska, and I have already reported it from southern Illinois and Kentucky. It also occurs in southern Ohio, where it has been collected in Lawrence County, in August, 1888, and July and September, 1889, and in Warren County, where we took it during the summer of 1889. I have also received a number from Arkadelphia, Arkansas, collected in 1887; and Mr. Theodore Pergande has kindly sent me a number collected at Marshall Hall, Maryland, August 21, 1887. Prof. W. B. Alwood has added a few taken at Blacksburg, Virginia, and my brother, Howard Evarts Weed, has sent a large number from Mississippi.

NEW HAMPSHIRE COLLEGE.